Enterprise Job Roles and Resistance to ERP Use: Actual Usage as an Antecedent to ERP Resistance

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Abstract

Resistance to system usage continues to be a research area needed to improve the ROI of organizational investments in information technology. Prior research on technology adoption has called for more sophisticated conceptualizations of systems usage that focus on specific research contexts.

This team-based experiment used a realistic business simulation to investigate use of an integrated ERP system, focusing on IS Resistance as a barrier to use. The understanding of IS Resistance is further enhanced by the inclusion of a new factor, Task Interdependency on the ERP system and by analyzing individual's specific roles and transactions within the ERP-supported process. The roles supporting integrated business processes consisted of two upstream roles (Inventory Specialist, Purchasing Agent) and two downstream roles (Marketing Coordinator, Sales Manager). Findings show task interdependency on ERP and ERP job role assignments are significant predictors of IS resistance, over and above effects of prior IS resistance and UTAUT attitude.

1. Introduction

Resistance to system usage is an emerging and maturing area of technology adoption and usage research. It is of interest due to the need to achieve productivity gains leading to improved ROI for ERP investments. Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) concepts [1, 2] have often been used to predict technology adoption and usage. However, these constructs do not reflect significant barriers to adoption and use such as IS resistance [3] or Technostress [4, 5]. Nor does the TAM/UTAUT approach address differences in IS usage based on job roles, where each roles requires well-defined types of information system use to perform their individual role in an integrated business process. This paper investigates what influences affect the outcome of IS Resistance [3] as high IS resistance can be a deterrent to ERP technology adoption and use [6].

A re-occurring obstacle to ERP productive use is resistance to ERP use [3], the existence of Technostress [4, 5] and the occurrence of ERP workarounds [7, 8, 9]. Many ERP implementations are met with strong resistance from current employees who must learn new business processes and quickly gain technical skills to perform jobs functions in the new system. Different job roles pose different demands on employees, yet little research as delved deeply into the specifics of differing job functions or the demands on individuals when they are expected to learn new business processes which require usage of a new ERP system. Role with regard to technology has been used to capture individual differences and their effect on TAM's usefulness and ease of use [10]. This study extends this research by looking at the cross-section between job role and deep usage of ERP (transactions).

In many prior technology adoption and use studies, there is an assumption that attitude and behavior will lead to actual usage. That linkage is often not explicitly or empirically made. When actual usage is studied as an outcome, the findings are not always consistent with self-reported indicators of intention to use IT. Several studies have found indications that self-report usage indicators may not be good surrogate measures for actual usage [11, 12]. Broader coverage of this issue is found in a meta-analysis based on a systematic evaluation of 75 published TAM datasets [13]. That study found that common method variance in TAM studies posed a validity threat to findings.

The existence of such a wide variety of information systems, the widely diverse job roles and the high task interdependency demanded by these integrated systems indicates the need for more specific conceptualizations of each system and the varying forms of system usage. Prior research on technology adoption has called for more sophisticated conceptualizations of systems usage and ones that focus on specific research contexts. "TAM should be revisited to ensure that usage is being measured in the best possible way, both from the standpoint of developing more sophisticated conceptualizations of what systems usage means in specific research contexts as well as from the standpoint of avoiding/estimating common methods bias." [14]

This study's team-based experiment focuses on IS Resistance as a barrier to use of an integrated ERP system. The experimental study was executed using a dynamic, high intensity ERP business simulation. The empirical study focuses on finding key factors beyond

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pre-intervention levels of IS resistance and UTAUT-based attitude to predict IS Resistance. This study additionally posits that IS Resistance stems from participant's Task Interdependency on team members and Technical Complexity of the system. The understanding of IS Resistance is further enhanced by the inclusion of new factors: Task Interdependency on the ERP system, and individual's specific roles within the ERP-supported process. The roles supporting integrated business processes consisted of two upstream roles (Inventory Specialist, Purchasing Agent) and two downstream roles (Marketing Coordinator, Sales Manager) (Figure 1).

Findings show Task Interdependency on ERP and ERP job role assignments are significant predictors of IS resistance, over and above the effects predicted by prior IS resistance and UTAUT attitude. Significant role variables indicate a difference above and beyond the overall factors of prior IS Resistance or Attitude and support the need to address job roles differently. The availability of actual transaction usage data further enhances the ability to understand different role responsibilities and how these can affect IS Resistance and potentially augment or interact with Attitude to provide a more successful implementation.

The remainder of the paper begins with the theoretical research associate with the Resistance to IT followed by a review of how situated activities and ERP workarounds justify a focus on how roles within an organization could adversely affect Resistance to IT. The theoretical background section concludes with a review of the UTAUT construct of Attitude and how the roles, along with the ERP system, construct a Transactive Memory System. The research model and resulting hypothesis will be presented followed by the experimental setup and data collection methods. Finally, an analysis of the results along with the contributions, conclusions and future research of this study will be reviewed.

2. Theoretical background

This study explores how job roles, interdependency on ERP and interdependency on other team mates can influence the outcome of IS Resistance to ERP. These variables help capture the individual's reaction to using the ERP system, and thus act as antecedents to IS Resistance. The primary contribution of this study is to present the impact of task interdependency on ERP and how various job roles influence IS resistance. It conceptualizes that job roles execute situated activities in performing the prescribed ERP-supported transactions to perform their part of the business process in closely coordinated relationships with other team members and with the ERP system itself. In these teams, each team member performs their specific job role, and uses the ERP System, such that all five elements (four team members and the ERP system) act as parts of a collaborative transactive memory system (TMS). Performing each different job role provides experiential-based expertise to the individual in that role, while the ERP system acts as a real-time information repository and coordinating element that mediates between team members as it performs a role of reliable, central communicator of decisions enacted and outcomes accomplished by the organization.

Resistance to IS has been shown to be effected by the users Attitude [2] and the Technical Complexity [15] of the system. Since the experiment included both pre and post measures of IS Resistance, the findings reveal the impact of the intervention on user variables from prior IS Resistance to post Resistance outcomes.

2.1. IS Resistance

User resistance to IS is defined as an adverse reaction, or opposition of users to perceived change related to new IS implementation [16]. For organizations to benefit from adopting integrated ERP systems and their 'best practice' business processes, the users need to become proficient in using the ERP system. Resistance to using technology and the occurrence of workarounds to the system are two major barriers to success with ERP systems [7]. Workarounds, that fail to use the ERP system as intended, are harmful as such irregular practices do not follow defined business practices, avoid using the system and therefore fail to provide business data and tracking information into the system in use by the rest of the organization [9, 8].

The main antecedents of IS Resistance have been derived from three different literature bases including that of technology acceptance, user resistance and 'status quo bias' [3]. Prior enterprise system

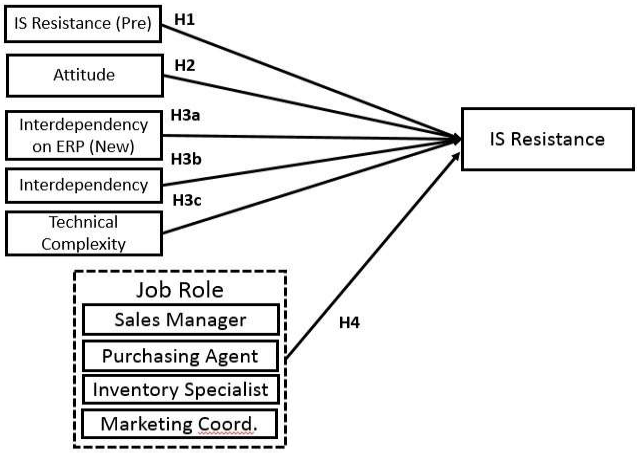

Figure 1 - Research Model

technologies were studied with a smaller system that did not include major ERP modules typically used in large companies which can span from manufacturing (such as MRP) to customer relationship management (CRM) and supply chain management (SCM) [3]. In this current study, roles focused on both supply chain for inventory management and also on the sales process for distribution to retail customers.

Each participant has one of four well-defined job roles and executes a small set of ERP transactions in coordination with the other three job roles in order to successfully run their distribution company while competing in a dynamic, competitive marketplace. As new users, each participant will experience a different type of ERP usage based on their assigned job role. Each role is performed using a small set of decision transactions and by monitoring a set of ERP reports (Table 1). Usage data will serve to double-check that no user could effect a complete system workaround.

2.2. Technology Acceptance and Use

There is extensive research providing valuable models to explain the acceptance of technology. From the early TAM [1] and its revised version of TAM2 [17], to the more comprehensive collection of antecedents in the UTAUT [2], a variety of predictors of attitude and expected behavior towards technology use have been identified. Most TAM2-UTAUT studies include two main antecedents (ease of use-effort expectancy and perceived usefulness-performance expectancy) in predicting outcomes of attitude or behavioral intention [2].

Only a small portion of those studies measure actual usage of the technology as the outcome. In many of these studies, there is an unstated assumption that attitude and behavior will lead to actual usage, but that linkage is not made explicitly or empirically in many studies. When usage is not voluntary, actual use of the system might be caused by individuals acting to conform to management mandates and organizational requirements [18]. While this study's research model uses attitude to predict IS Resistance, we have measures of actual mandated usage to support the findings of the research model.

2.3. Transactive Memory Systems (TMS)

A transactive memory system is a collection of differentiated knowledge sources called transactive memories (TM) of experts on a team who share information via interactions (i.e. transactions) between these same interdependent individuals. The existence of TMSs were first identified studying couples and how they differentially stored knowledge and experiential memories in support of interdependent goals [19, 20]. A TMS operates based on a shared understanding of 'who knows what' in the group. The structure of a TMS has been defined as consisting of two main elements of a set of transactive memories (TM) and a shared TMS directory [21]. A TM element is a member that is influenced by knowledge about the memory systems of other persons.

A TMS directory is often thought of as a shared understanding of the knowledge contained in individual TMs across the group. This directory is created by interactions during the team formation process and is continually updated and adjusted throughout the lifetime of the team. Thus, an individual updates the ERP element knowledge in their TMS directory as they learn about the ERP, its functions and what types of information it can provide.

This directory update process includes the TMS processes of information allocation and retrieval coordination [22]. Information allocation is the process that handles new information as it comes into the group and is communicated to the appropriate TM element to facilitate encoding and storage.

The study of TMS is often focused on task-oriented information. TMS are often build from memories of shared experiences [19], emerge from shared training [23], and can be based on shared knowledge regarding external resources [24]. Dyads and small interdependent teams are shown to benefit from the existence of TMS [25, 23].

The creation of a Transactive Memory Systems (TMS) is a knowledge management practice whereby team members differentiate their knowledge by specializing in different expertise domains. Team members then collaborate interdependently to share expert knowledge with others as needed. These collaborations provide each team member with a larger memory, through collaborative transactions, than individual memory alone retains. This practice expands the expertise available to each team member by expanding their domain of expert knowledge.

In business situations of ERP usage, group interaction occurs not only directly between individuals but with and through the ERP system's coordinating functional modules. Such systems are utilized to control and coordinate between different job functions as individuals perform their part of interdependent business processes. ERP systems are designed to support the processes of entire organizations and include support for both upstream (purchasing and inventory status) and downstream (sales and marketing) processes. Positing that an ERP system can be viewed as an element of the organization's transactive memory (TM), this study builds on prior TMS research where individuals were primarily considered to be the knowledge-holding elements in a TMS. In this study, five elements are incorporated in the TMS, these TM elements consist

of four organizational job roles (with interactions among individuals) and an ERP system (heavily used in both individual transactions and in coordinating between users). These key TMS elements are represented in Figure 2 – Coordinating Team Roles.

Prior research in several fields have repeatedly demonstrated that a TMS is influential in improving performance in small teams. This study includes the IT system, specifically an ERP system, as part of the small TMS team and is an additional source of expert knowledge (thus serving as an additional TM element). In other words, this research conceptualizes an ERP system as an alternative knowledge resource that is part of the TMS. Actual ERP transaction usage and frequency data from the experimental system are used to determine how different team roles interact with the actual system. Learning how to better utilize ERP as a part of a TMS could expand the team expertise and improve process execution. New ERP users must learn to utilize ERP-based knowledge. Knowledge is required both to navigate the ERP system as well as to develop a clear understanding of the business process steps, interactions and dependencies. Effectively using a complex ERP system requires the individual development of technical and process knowledge before the ERP system can become a viable member of the TMS.

2.4. Team Roles

The use of teams in organizations reside in the organizational goal to increase organizational effectiveness [26]. The source of these changes are a result of the ability to "access knowledge from three sources: the organization's memory, each individual's memory and external market information" [27]. Conceptualizing the ERP system as a TM element, the four team members are able to access knowledge concerning their tasks from their team members and the ERP system (Figure 2). Based on the usage data from the ERP system, job responsibility migration can also be assessed (Note: The usage data source is a system transaction analysis data (STAD) file. How this data is assembled is beyond the scope of this paper.). In addition, the ERP system provides the ability to access market information concerning the sales of other teams.

The primary premise for evaluating job responsibility migration in the business simulation include system interaction and team interaction with respect to both task responsibilities and report analysis. The task responsibilities represent a level of decision making by the individual holding that particular role. The report analysis for each job represents a judgment on both their decisions as well as other members of the organization. The following role descriptions explain the decision related task and reports available for each task assignment. A summary table (Table 1 – Cross Role Use) is included to identify the assigned tasks and reports along with the potential cross role use that may exist in the TMS.

The sales manager's (SM) downstream task is to adjust the pricing of each product in order to either enhance profitability by raising the price or increase sales by lowering the price. The task name is VK32 – Condition Maintenance: Change. The assigned analysis report is ZVA05 – Sales Order Report. This report shows the individual sales transactions for the SM's organization and includes the number of bottles sold and the price per box.

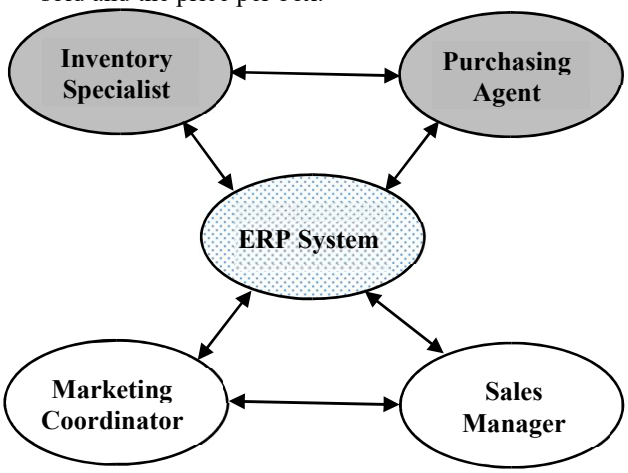

Figure 2 – Coordinating Team Roles

The inventory specialist's (IS) upstream task is to adjust the forecast – transaction code MD61. A higher forecast will increase the number of days between purchasing for each product. The frequency of change for the forecast is very low and therefore an infrequent to non-existent use of this task is expected. The IS has two reports for analysis: 1) ZMB52 – Inventory report and 2) F.01 – Financial Statements. ZMB52 is monitored daily to assess when to order additional

Job Assignment	Code	Type	Other role likely to use
SM	VK32	Transaction	MC
SM	ZVA05	Report	IS, MC, PA
IS	F.01	Report	SA, MC, PA
IS	MD61	Transaction	MC, PA
IS	ZMB52	Report	SA, MC, PA
MC	ZADS	Transaction	None
MC	ZMARKET	Report	SA, IS
MC	ZVC2	Report	SA, IS, PA
PA	MD01	Transaction	None
PA	ME59N	Transaction	None
PA	ZME2N	Report	None

Table 1 – Cross Role Use

product and the initial report used by all roles to become familiar with the ERP system. The reports must be refreshed in order to have the data updated to the current day in each round.

The marketing coordinator's (MC) downstream task is to determine the daily level spend for each of the six products for three sales areas. This level is entered as euros/day for a specified area. The task name is ZADS – Marketing Expense Planning. There are two analysis reports assigned to the MC: 1) ZMARKET – Price Market Report, and 2) ZVC2 – Summary sales report. The ZVC2 report shows the internal daily sales for each product and the sales area for those sales. The ZMARKET report is available after every 5th day and shows the total sales by both Value and Units for the prior 5 day period for each area for all participating teams in the simulation.

The purchasing agent's (PA) upstream task is the ordering of product to replenish inventory. The task is a two-step process in the following order: 1) MD01 – MRP Run, and 2) ME59N – Automatic Generation of Purchase Orders. Executing MD01 results in the creation of purchase requisitions. ME59N automatically converts the purchase requisitions to purchase orders. The report analysis assigned to the PA is ZME2N – Purchase order tracking. This report allows the PA to assess how many days it generally takes to receive the product into inventory from the issue of the purchase order. The PA does not have the assignment to monitor the inventory level and so must depend on communicating with the IS in order to determine when to initiate the purchase process.

3. Research Model and Hypotheses

The research goal is primarily to execute a deeper investigation into antecedents of IS Resistance to use. A focus is placed on the degree of interdependency on ERP and the effects of well-defined job roles which inherently rely on a set of specific ERP transactions. Attitude to use, the assigned roles with respect to system usage and the control variable for prior IS resistance (pre-intervention) are all posited to impact the IS Resistance to use the ERP system. Hypotheses indicated in the research model (Figure 1) begin with the existing resistance to IS use (H1), the user attitude (H2), the task interdependency on the ERP system (H3a) and task interdependency on team mates (H3b). The concluding hypothesis assesses the perceived technical complexity of the system (H3c) and the impact of each individual four roles (H4).

3.1. IS Resistance – Pre

Reducing IS Resistance for system users is a primary goal for organizations to ease their system implementations. This is true when there is a new system, but also true for modifications to existing systems. System users bring with them an existing resistance to system use that can be modified via productive and supportive guided system usage experiences. The nature of this ERP intervention consisted of clear concise documentation, immediate availability of a knowledgeable expert and team support. Conditions in such an intervention can accelerate the experiential learning curve with a new technology. Reactions to a technology will change over time based on increasing competency gained through productive interaction with the prescribed system. However, even with these stated interventions, the prior levels of resistance to IS will impact the ability to fully eliminate IS resistance and therefore provide a significant predictor of the future (hopefully diminished) level of IS Resistance and leads us to the first hypothesis:

H1: Prior IS Resistance will positively impact future IS Resistance

3.2. Attitude

The attitude individual users bring to new system implementations has been studied in multiple settings in prior literature. These settings include the constructs of attitude toward behavior [1], user's intrinsic motivation [28], and affect toward use [29]. Both the early TAM/TAM2 model and the later UTAUT model findings support that user's positive attitude toward technology use will result in higher behavioral intention to use that technology. A higher intention to use a technology is the opposite to resistance to the usage of a technology, and leads to the hypothesis.

H2: A positive Attitude to ERP usage will decrease IS Resistance

3.3. Tasks & Technical Complexity

The independent variables of Perceived Technical Complexity (TC) and Task Interdependence (TI) on teammates were based on prior research [30]. An adaptation of the TI construct is to regard an ERP as a TMS element, and therefore an interdependent member of a close-knit team in performing an integrated business process. The interdependency on the ERP system (TI-ERP), as a TMS element, may be a factor in predicting IS resistance. The TI-ERP introduces a way to consider the ERP system as having close ties to the job tasks where the individual must directly and successfully interact with the ERP to succeed in their job function. An interaction with the ERP system would necessarily differ from individual to individual just as the interactions among team members differ. The side benefit of interacting with

the ERP system is that all of these interactions can be captured and organized as business information. This is why management endorses and requires ERP use. Studies have shown that mandatory use situations differ from discretionary use situations [2, 10].

Essentially, the more individuals are required to use and depend on the ERP system, the lower their resistance to using the ERP system. These task interdependency factors and the technical complexity of the system are expected to help further illuminate the understanding of IS Resistance impact. From prior literature and the indication of the new TI-ERP construct above results in the following hypothesis.

H3a: Increased TI-ERP will lower IS Resistance
H3b: Increased TI will lower IS Resistance
H3c: Increased TC will increase IS Resistance

3.4. Job Roles

The influence of job role on IS resistance is explored by explicitly defining and assigning four job roles. These job roles are defined based on several aspects: 1) organizational work flow (upstream or downstream), 2) level of interaction with teammates, 3) level of interaction with the system, and 4) the types of transaction (decisions or reports).

Organizational work flow is separated into upstream and downstream functions. The upstream functions include product purchasing, product forecasting and the maintaining of inventory to support the downstream functions. The downstream functions include product pricing, marketing levels and scanning functions associated with the competitive market place. These functions are accomplished by various decision making transactions and supported by a number of reports to insure a timely use of product and market changes. The decision and reporting transactions can all be captured by the ERP system and represent system usage.

The Sales Manager (SM) downstream role is primary responsibility for the setting of product pricing and is expected to have the highest level of interaction with all teammates. This interaction includes the need to scan multiple aspects of the ERP system in order to determine both market receptiveness of the product pricing along with the inventory levels and purchasing of products to insure sales. The SM will have the lowest IS resistance due to this need to interact with all other job roles and a higher need for IT-ERP information support.

H4a: SM role will have the lowest IS Resistance

The Marketing Coordinator (MC) downstream role is primarily responsible for setting the expenditure level for product marketing. Discussion of this objective would primarily be with the SM as the SM would know the current margin between product purchase and price setting. The only interaction needed with the ERP system would be the setting of the marketing levels. The reduced need to access the ERP system and a reduced need to interact with the other team members, specifically the IS and PA roles, would lead to a higher IS resistance.

H4b: MC role will have higher IS Resistance

The Purchasing Agent (PA) upstream role has a high level of ERP system interface in order to accomplish their tasks. The task is a multi-step work process that relies on properly synchronizing multiple decision transactions. This process is very scripted and offers little variance in the execution of this task. In addition, their need to interface with other team members is minimal since the interaction is short and concise with a dichotomous yes or no to the timing of product ordering. The easy interface with teammates coupled with a more repetitive ERP system interface does not provide a noteworthy level of interaction and subsequently will result in higher IS resistance.

H4c: PA role will have higher IS Resistance

The Inventory Specialist (IS) upstream role has a limited ERP system interface focused only on modification of the forecasting of product needs and monitoring of current inventory levels. The monitoring of inventory levels is relatively simple to add to any other job role. Modification of the forecast is the least frequent decision point of all decision activities within the teams. The lack of a major level of ERP interface and limited team interaction result in the IS role exhibiting higher IS resistance.

H4d: IS role will have higher IS Resistance

Actual usage of both the decision-making and reporting transaction types captured by an ERP System can create the interaction profile of each team role in order to support the hypothesis results. The frequency of the decision-making modifications of each role will indicate both support of the hypothesis and the profile of each role as well as any cross-role activities to which the roles may expand.

4. Experimental Setup

Data collection occurred across semesters with each simulation run referred to as a simulation engagement. The engagements consisted of twenty-four different classes at three locations. No prior

training given to any of the students taking the courses with respect to the simulation. Each of the courses were chosen based on the inclusion of content providing instruction on enterprise resource planning system concepts. The exercise consisted of a business simulation (ERPsim – Distribution) in which teams compete for customers by purchasing and reselling water bottles [31]. The participants had no prior experience with this ERP system or its transactions.

Each experimental engagement had between four and eight teams. The goal for all teams was to include an individual responsible for each identified role., Some teams of 2 or 3 members occurred due to absences and unequal class sizes. The data analyzed is limited to teams containing all four business roles.

Initial instruction included outlining the market context and describing the overall operation of the businesses. Organizational success was defined as the highest net income for their organization. All participants were instructed on basic navigation and each task described by stating its primary decision function along with introducing its transactions and relevant reports. When each role was discussed, the individuals assigned to those roles in each group were asked to review their assignments based on the role job aids.

The engagement consisted of three rounds of 20 virtual days and lasted approximately 20-25 minutes per round. The time between each round was used to field general questions and review the financial standings of the organizations. Questions concerning both report interpretation and operational transactions were fielded during the simulation but team strategy questions were left to teams for decision-making.

The analysis consists of the 78 teams where four individuals participated in all three simulation rounds. Each team member was assigned a specific role: 1) Sales Manager (SM), 2) Inventory Specialist (IS), 3) Marketing Coordinator (MC), or 4) Purchasing Agent (PA) and provided an assigned role responsibility job aid. Each team was given two summative job aids that would provide a guide for accomplishing any task or reviewing any available report for all assigned roles. Role assignments and their related data were tracked via the student's login.

Each role will have a learning curve based on the individual knowledge as well as the demands of the particular role. With an ERP system, one of the main goals is to have information available to all organizational members. However, the more relevant information not assigned to a role, the more likely the role will be to access that information across roles. For instance, the upstream role of inventory specialist is most likely to access the reports for the purchasing agent and potentially run their decision-making transactions than the downstream roles of sales manager and marketing coordinator. Table 1 – Cross Role Use provides the initial expectations of cross role use of each report and decision transaction.

5. Data Collection

Data collection used items from prior literature. This study included the published measures for the independent variables of Technical Complexity (TC) [30], Task Interdependence (TI) [30], Attitude [2] and the dependent variable factor of IS Resistance (Resist) [3]. The new measure for personified ERP system on a team, referred to as Task Interdependence on ERP (TI-ERP), was based on 3 items of the measures for Task Interdependence [30]. The pre-survey was administered to participants immediately prior to

Variable	N	Resist–Pre	Utaut–Att	TI	TI-ERP	TC	D-PA	D-IS	D-MC
Resist–Pre	279	1.00							
Attitude	278	-.2168***	1.00						
TI	235	-.2859***	.0616	1.00					
TI-ERP	235	-.2938***	.0780	.8312***	1.00				
TC	235	.2334***	-.0826	-.3897***	-.4629***	1.00			
D-PA	279	-.0765	.1077	.0230	.0557	-.1078	1.00		
D-IS	279	.0482	-.1150	-.0565	-.0211	.0231	-.3390***	1.00	
D-MC	279	.0004	.0220	.0187	.0366	.0341	-.3277***	-.3390***	1.00

p < .001 - *** p < .01 - ** p < .05 - * ns = not significant

Table 2 – Correlation Matrix

commencing the engagement and the post-survey was administered immediately following the experiment's conclusion.

The initial assigned roles (categories) for each 4-person team were identified using dummy variables. The reference role was selected as the Sales Manager (a downstream role) and indicated as 0-0-0 for the three named dummy variables [32]. The selection of the Sales Manager as the reference role follows the suggestion that the category be the one scoring highest or lowest (in this case lowest) of the independent variable [33]. The three named dummy variables included in the regression were Dummy – Purchasing Agent (D-PA), Dummy – Inventory Specialist (D-IS), and Dummy – Marketing Coordinator (D-MC).

6. Analysis

Assessment of the regression model was performed using the SAS Enterprise Guide 7.1 statistical software package. The model analysis progressed through assessing the factor correlation matrix (Table 2), a review of the regression model results (Table 3 and Figure 3) and review of the regression variable coefficients (Table 4).

Source	df	Sum of Squares	Mean Square	F Value
Model	8	230.33	28.79	25.89***
Error	225	250.24	1.11	
Corrected Total	233	480.57		
Root MSE	1.05	R-Square	0.48	
Dependent Mean	2.57	Adj R-Sq	0.46	

Table 3 – Model Results

Variables	df	Parameter Estimate	t Value	Pr > |t|	
Intercept	1	3.871	5.51	<.0001	***
Resist - Pre	1	0.410	7.20	<.0001	***
Attitude	1	-0.176	-2.48	0.0140	*
TI	1	-0.011	-0.10	0.9181	ns
TI-ERP	1	-0.439	-4.21	<.0001	***
TC	1	0.137	1.67	0.0958	ns
D-MC	1	0.455	2.26	0.0245	*
D-IS	1	0.216	1.11	0.2674	ns
D-PA	1	0.446	2.21	0.0284	*

Table 4 – Regression Variable Coefficients

6.1. Correlation Matrix

The correlation matrix (Table 2) indicates a significant correlation at $\alpha < .001$ confidence level between the initial measurement of Resistance and the independent variables of Attitude, TI, TI-ERP and TC. In addition, the independent variable of TI, TI-ERP and TC are all significantly correlated at $\alpha < .001$ with each other. The dummy variables used to capture the roles were all significantly correlated with each other. All statistical tests use a p-value of 0.05 (or better) for significance (indicated in Table 2).

6.2. Regression Models

The regression analysis resulted in a model that was significant at $\alpha < .001$ confidence level (Table 3). This model provided an adjusted explained variance of 46% ($r^2_{adj} = .46$) which is above the typical effect range for publications in top IS journals (Mani et al. 2010; Tian et al. 2015). The significance of the variable coefficients (Table 4) are indicated in accordance with the p-values stated in Table 2.

6.3. Discussion

This study was focused on assessing the Resistance to IS post engagement. The intervention set up a working commercial ERP environment in which the participants interacted with each other and the ERP system to gain experience in job functions while relying on the ERP system to perform their individual job role. As indicated in H1, the IS Resistance prior to the engagement was positive related to the IS Resistance post engagement. However, the parameter estimate (Table 4) indicates that only .41 of the variance is carried to the post IS Resistance with all

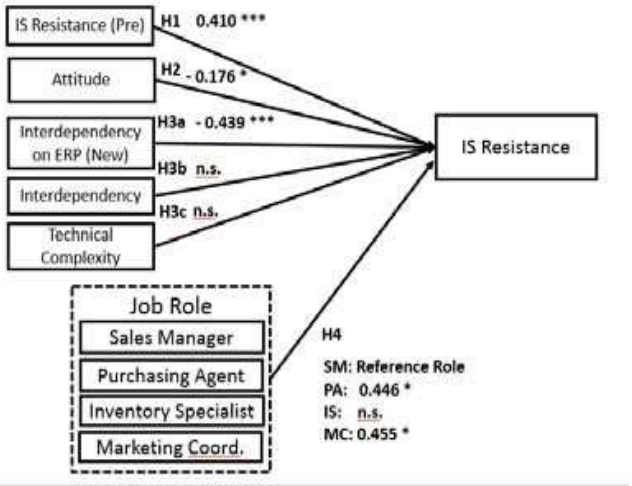

Figure 3 - Model Results

other variables remaining constant. This translates to an overall reduction in the resistance to ERP usage post engagement and supports hypothesis H1.

Two factors, Attitude and IT-ERP, provided significant reductions in IS Resistance. The reductions were -0.176 and -0.439 respectively. This is an indication of the reduction in the post IS Resistance and support H2 and H3a respectively. With all other variables remaining constant (especially the dummy variables that should be viewed as 0-0-0 for this example), these results and the model significance support that the SM role has the largest reduction in IS Resistance and therefore supports H4a.

The use of the dummy role variables provides only a comparison with the reference SM (downstream process) role and support for each hypothesis is based on the direction of the variable coefficient. The IS (upstream process) role did not show a significant difference in IS Resistance to the SM role. Without a significant difference for the IS role, this would indicate that the post IS Resistance is not significantly different and therefore indicates a lack of support for H4c. Both the SM and IS roles attained all the benefits of resistance reduction captured by the Attitude and IT-ERP variables.

There are two roles whose resistance is significantly different from the SM role. Those roles are the PA (upstream process) role and the MC (downstream process) role. The comparison of the SM with PA may be explained based on system feedback for the job performance. The PA was responsible for insuring that there was product available at all times for the team to continue making sales. The monitoring of the inventory was an IS responsibility and this dependence on a teammate may have reduced the benefit of feedback from the ERP. In addition, the availability of ERP feedback on when to order was not part of the system. The timing of the orders was critical, but not ERP dependent. Therefore, the full benefit of interfacing with the ERP was not obtained in the way the SM obtained the benefit. This supports hypothesis H4b that the PA would have an increased IS resistance over the SM.

Comparing the SM with the MC, both downstream roles, the MC shows a 0.455 increase in resistance over the SM role. The main explanation of the difference in usage may be based on the job requirements of the two roles. While the SM focused on pricing of the products and monitoring of how their teams pricing matched the opposing teams pricing, the MC was focused on only setting the marketing dollar expenditures with the system. The SM was able to obtain feedback from the ERP via market reports on the opposing team prices, while the MC had no feedback concerning the effectiveness of their pricing strategy. While the MC used the ERP as much as the SM, the feedback on job impact associated with the market report impacted the SM resistance to a greater extent than the MC. The result for the MC roles is an increase in IS Resistance over that SM and lends support for H4d. These results are summarized in Table 5 - Hypothesis Results

7. Contributions and Future Research

The primary contribution of this study is twofold and indicates a path forward to further assess the ERP system as a TM element along with the impact roles play in the reduction of IS resistance. The first contribution is the construct of TI-ERP and the significance of the ERP system with respect to task interdependency as opposed to team member interdependence. The resulting find may indicate a need to explore the extent and longevity of assistance from other teammates as to system use. Once an individual narrows their focus on system learning, there may not be a significant impact on team mate task interdependence but the ERP system interdependence does not reduce.

The use of roles differentiation has been established based on the dummy variables included in the experiment. Additional research into the extent of interaction with the system and their closest partners (downstream or upstream) in light of the role responsibilities could yield additional insights as to the potential to reduce IS Resistance to use. This additional path can be assessed based on the usage data available through the ERP system.

Hypothesis	Variable	Support
H1	IS Resistance (Pre)	Supported
H2	Attitude	Supported
H3a	Interdependency on ERP	Supported
H3b	Interdependency	Not Supported
H3c	Technical Complexity	Not Supported
H4a	Sales Manager	Supported
H4b	Purchasing Agent	Supported
H4c	Inventory Specialist	Not Supported
H4d	Marketing Coordinator	Supported

Table 5 – Hypothesis Results

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